

ELASTIC ANALYSIS OF SHORT SPAN
CONTINUOUS FOLDED PLATES

A Thesis Submitted

by

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CERTIFICATE

Certified that this work "Elastic Analysis of Short Span Continuous Folded Plates" by Mr. Christopher Rajkumar has been carried out under my supervision and it has not been submitted elsewhere for a degree.

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SYNOPSIS

Many design methods available for the analysis of folded plates are basically developed for folded plates with configurations suitable for roofing purposes. When folded plates are used as bunkers, because of the different configuration, it may not be possible to use these methods directly. This dissertation attempts to formulate, with certain limitations, design methods suitable for the analysis of folded plates with cross sections and forms of continuity required for roofs as well as bunkers.

A method of analysis for multiple folded plates based on transfer matrix method has been presented in Chapter 3. An explicit form of point matrix to cross over ridges containing multiple plates has been developed by the writer. Application of this method to multiple folded plates has been demonstrated and its accuracy has been checked with stiffness matrix method.

Energy method originally proposed for single span folded plates has been extended herein to continuous structures in Chapter 4. Using shape functions, or vibration modes of beams, energy expressions have been derived. A two-span folded plate has been chosen as an illustration for the derivations. The results so obtained have been found to be satisfactory. Application of energy method to folded plates with tie rods has also been shown.

Theoretical results have been compared with the experimental results of an aluminium model.

A successive correction procedure proposed in Chapter 5 for folded plates with diaphragms not externally supported uses only three unknowns (rigid body movements) per each movable diaphragm. This method is thus based on stiffness approach. Force method of analysis of folded plates with intermediate diaphragms involves a large number of unknown redundants irrespective of the diaphragm being externally supported or otherwise. The energy method of Chapter 4 eliminates the unknowns due to non-sinking diaphragm because of the shape function. The proposed successive correction method does not involve any unknowns at the non-sinking diaphragms and requires to solve for three unknowns only per diaphragm. An example has been analysed using this approach and the results have been checked. Application of this method to continuous folded plates has also been discussed with the help of another example.

A method of analysis for folded plates with inclined diaphragms has been discussed in Chapter 6. An approximate analysis has been proposed which takes the effect of inclined diaphragms as boundary forces over the prismatic portion of the structure. Results from an experimental investigation have been used to check the

accuracy of the proposed method.

Application of finite element technique to folded plate structures has been discussed in Chapter 7. A computer program was written based on rectangular finite elements with inplane and out of plane actions, and it was used to check the results of design methods proposed in the present investigation.

Experimental investigations on four models - three aluminium models and one Araldite photoelastic model - were carried out to check the applicability of the proposed theoretical methods.

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